

## APPARATUS AND METHOD OF PROCESSING CHARACTERS

### BACKGROUND OF THE INVENTION

#### Field of the Invention

5           The present invention relates to an apparatus and a method of processing characters by which characters are arranged in an area.

          The present invention relates to an apparatus and a method of processing characters by which a group of  
10       characters are divided to be stored.

#### Related Background Art

          In recent years, with many character processing apparatuses, not only character data contained in a document can be processed, but also image data, e.g.  
15       tables or graphics, contained therein can also be processed mixedly. The document processing apparatus of this sort is designed in such a way that before inputting the characters, the character line can be inputted to a specified rectangular area one character  
20       by one character using a keyboard, the characters, for which the range is specified, of the inputted character group can be inputted by being moved or copied, or can be transferred to that area. In addition, some of those apparatuses can carry out the control in such a  
25       way that the graphics or the like and the character data do not overlap each other.

          In addition, Windows (Microsoft) or the like have

come into wide use recently so that it has become possible that a plurality of documents are simultaneously edited when drawing up the documents, and also it has become possible by utilizing  
5 simultaneously various applications that a plurality of works are carried out simultaneously and in parallel.

As a result, for the character data within the area in which a plurality of character data contained in the same document is to be arranged, and for the  
10 character data contained in a plurality of documents, the copy and the movement have been able to be readily carried out.

However, when the movement, copy and transfer of the character line have become to be readily carried  
15 out either between a plurality of documents or in the single document, a large amount of character data may be transferred to the small area, which has the less number of displayable character data, in edition of the document(s) by the maloperation which an editor does  
20 not intend in some cases.

In addition, in the document processing apparatus in which the rectangular area, in which the character data is to be displayed, is previously specified, in general, the format information such as the size of the  
25 specified area and the position of arrangement of the character data can be changed after having arranged once the characters. In this connection, even when all

of the character data is displayed in the area before changing the size of the area and the format attribute, by reducing the size of the area and by changing the attribute of the character size, there may occur the  
5 case where the characters any of which can not be displayed, are generated within the area.

Then, if the character data which is left since it is more than the specified area can receive, is generated, then the character data which is left since  
10 it is more than the specified area can receive, will not be displayed on the picture at all. In particular, when the characters are uniformly arranged within the area, since the character data which is left since it is more than the area can receive, is not displayed, an  
15 operator can not visually judge whether or not the character data which has overflowed from the area is present, and hence such character data is left as it is in many cases.

Then, the character data which is left as it is,  
20 while not displayed, present as the character data, which results in that the memory is unprepared wasted.

Further, even when an operator becomes aware of that the character data which is left since it is more than the specified area can receive, is present, an  
25 operator needs to carry out the work of carrying out the document edition after having changed the size of the character arrangement area in such a way that all

of the character data which is left since it is more  
than the specified area can receive is displayed, and  
then restoring the size of the character arrangement  
area back to the original size. Therefore, the work of  
5 editing the character data is troublesome and  
complicated.

In addition, when the character data is read out  
from the text file to be successively transferred to be  
associated with the area, there is the case where  
10 however the area is increased, all of the character  
data can not be displayed since it is more than that  
area can receive. In such a case, the character data  
the amount of which is equal to or larger than the  
number of characters overflowing from the area needs to  
15 be deleted. In this connection, a part of the  
character line which is displayed within the area needs  
to be deleted and in addition thereto, a part of the  
overflow character line which becomes to be displayed  
as a result of that deletion needs to be deleted, and  
20 so forth. Therefore, an operator needs to carry out  
the very complicated work.

#### SUMMARY OF THE INVENTION

In the light of the foregoing, the present  
25 invention has been made in order to solve the  
above-mentioned problems associated with the prior art,  
and it is therefore an object of the present invention

to provide an apparatus and a method of processing a document by which the character data which can not be arranged in an area can be readily edited by reporting the fact that there is the character data which can not  
5 be arranged in an area to an operator, and then by moving the character data which can not be arranged in an area to another area (or another position of the same area).

In addition, it is another object of the present  
10 invention to enhance the operationability and the reliability in the edition of the characters which overflow so that they can not be outputted by carrying out the storage control or the output control with respect to the characters which overflow from the area  
15 when they are left since they are more than the area which is specified in order to output the characters can receive.

#### BRIEF DESCRIPTION OF THE DRAWINGS

20 Fig. 1 is a block diagram showing a configuration of the overall apparatus according to an embodiment of the present invention;

Fig. 2 is a diagram showing an example of the information which is stored in order to manage a  
25 character arrangement area;

Fig. 3 is a diagram showing the typesetting information which is used to calculate the arrangement

position of the character line which is arranged and displayed in and on a character editing apparatus shown in the embodiment;

Fig. 4 is a flow chart useful in explaining the line arrangement processing in an area in the embodiment;

Fig. 5 is a flow chart useful in explaining the processing of creating line information of the n-th line in the embodiment;

Fig. 6 is a flow chart useful in explaining the method of judging the overflow characters in the embodiment;

Figs. 7A, 7B and 7C are diagrams showing an example of the method of displaying the overflow characters in the embodiment;

Fig. 8 is a diagram showing a display example when no character overflows from an area, and the method of moving the overflow characters in the embodiment;

Fig. 9 is a diagram showing a display example of the overflow characters, and the method of moving the overflow characters in the embodiment;

Fig. 10 is a diagram showing the change in the stored information when moving the overflow characters in the embodiment;

Fig. 11 is a diagram showing the method of inserting the moved character data into another area in the embodiment; and

Fig. 12 is a diagram showing the change in the stored information when inserting the moved character data into another area in the embodiment.

5 DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiment of the present invention will hereinafter be described in detail with reference to the accompanying drawings.

Fig. 1 is a block diagram showing a configuration of an apparatus of processing characters according to an embodiment of the present invention.

The present apparatus includes: a display unit (CRT) 1; a video random access memory (VRAM) 2; a bit move unit (BMU) 3; a keyboard 4; a pointing device (PD) 5; a central processing unit (CPU) 6; a read only memory (ROM) 7; a RAM 8; a hard disc drive (HDD) 9; a floppy disc drive (FDD) 10; and a network interface (Net-I/F) 11. Those constituent elements are connected to one another through an input/output (I/O) bus 12 consisting of an address bus, a data bus and a control bus. In addition, the CRT 1 is connected to the VRAM 2.

The document in edition and the various message menus are displayed on the CRT 1. The VRAM 2 develops the characters and the image which are displayed on the CRT 1 and also stores therein them. The BMU 3 controls the transfer of the information between the constituent

elements. The keyboard 4 includes the various keys which an operator uses when editing the document. The PD 5 is used to point out the icon or the like which is displayed on the CRT 1.

5 In addition, the CPU 6 controls the constituent elements on the basis of the control program which is stored in the ROM 7 and also executes the processing of controlling the character line arrangement as will be described later. The ROM 7 stores therein the program  
10 relating to the document edition, the error processing program and the program for processing the character line arrangement. The RAM 8 is used as the work area or shelter area in the error processing when the CPU 6 executes the various control programs as described  
15 above.

In addition, each of the HDD 9 and the FDD 10 preserves therein the program relating to the character line arrangement processing as will be described later, the various information and libraries. Also, the  
20 Net-I/F 11 carries out the control and the diagnosis of the network information in such a way that the present apparatus can carry out the transfer of the information between the present apparatus and other document processing apparatus through the network.

25 It is to be noted that the control program which is stored in the above-mentioned ROM 7 may also be stored in the storage medium such as a hard disc (HD),



a floppy disc (FD) or a removable disc (RD) (all not shown) which is specially connected to the present apparatus. Also, alternatively, the control program may be stored in the

5 storage medium which is additionally provided in another document processing apparatus or a computer which is connected to the present apparatus through the network.

10 Next, the description will hereinbelow be given with respect to the information which is employed in the document editing processing in the present embodiment.

15 Fig. 2 is a diagram showing the information which is stored in order to manage the character arrangement area with which the present embodiment is realized.

Now, it is assumed that each of the information shown in Fig. 2 is stored in a character area data managing unit of the HDD 9 or the FDD10.

20 An area 2a is the area in which the number, [num\_areas], of character areas present in the document for which the edition is to be carried out, is stored; an area 2b is the area in which the information relating to the first character area of the character areas which are managed within the document, is stored; 25 and an area 2c is the area in which the information relating to the n-th character area thereof is stored. In the areas ranging from the area 2b to the area 2c,

as shown in Fig. 2, the area information of the number of the numeric value which is represented in the form of [num\_area] is stored in the order of the area numbers in the character area data managing unit.

5           Then, the contents of the information relating to the individual character areas are written to the areas ranging from an area 2d to an area 2j.

10           The areas 2d and 2e are the areas in which the coordinate values as the references of the character areas are stored. In the present embodiment, each of the shapes of the character areas is rectangular and the coordinate values (pos\_x, pos\_y) at the vertex of the top left of the rectangular area are stored as the reference coordinates. In addition, the areas 2f and 15 2g are the areas in which the information relating to the shape and the size (height and width) of the character area is stored. In the present embodiment, since the character area has the rectangular shape, the height [area\_height] and the width [area\_width] of the 20 area are stored in the areas 2f and 2g, respectively. In addition, the area 2h is the area in which the format information [area\_info] which the character data within the character area shown in the present embodiment has is stored. The information relating to 25 the format name, the format size, the line interval, the line pitch, the character interval and the like as the format information which is used to display the

characters within the area is stored in the area 2h.  
The format information is inputted to be stored when a  
new area is set by a user, or when the update is  
carried out by a user.

5           In addition, an area 2i is the area in which the  
information of the character data displayed in the  
character area shown in the present embodiment is  
stored, and the contents contained therein includes: in  
addition to an area 2k in which the number,  
10   [total\_words], of character data, to be arranged in the  
area is stored; an area 2l in which the first character  
code to be arranged is stored; an area 2m in which the  
second character code is stored; an are 2n in which the  
n-th character code is stored, and the like.

15           In addition, the area 2j is the area which is used  
in the typesetting which is used to calculate the  
arrangement position of the character data which is to  
be arranged and displayed in the present embodiment.  
The details of the information stored in the area 2j is  
20   shown in Fig. 3.

Fig. 3 shows the typesetting information which is  
used to calculate the arrangement position of the  
character line which is to be arranged and displayed in  
the character processing apparatus shown in the present  
25   embodiment.

Now, an area 3a is the area in which the number,  
[num\_lines], of lines which are arranged in the area is

stored; an area 3b is the area in which the line  
information of the first line is stored; and an area 3c  
is the area in which the line information of the n-th  
line is stored. In such a way, the line information  
5 for the number of lines which information is stored in  
the area 3a is stored, every line, in the areas 3b to  
3c. Then, the detailed information which is contained  
in the respective line information is stored in areas  
3d to 3g which will hereinbelow be in turn described.

10 The area 3d is the area in which the line number,  
[line\_no], of the line of interest in the area having  
the line of interest contained therein is stored, and  
the area 3e is the area in which the baseline  
coordinate (baseline) of the line is stored. In the  
15 present embodiment, the baseline of the line  
corresponds to the position which is lower than the  
upper end, [pos\_y], of the rectangular area by the  
character size information in the case of the first  
line of the area, and corresponds to the position which  
20 is lower than the baseline position of the line right  
before the first line, i.e., of the line the line  
number of which is smaller than that of the first line  
by one line by the line pitch in the case of not the  
first line. In the present embodiment, the character  
25 size information and the information of the line pitch  
and the like are stored as the format information in  
the area 2h.

In addition, an area 3f is the area in which the offset, [start\_offset], which exhibits where the character code arranged in the head of the line of interest is ranked in the character data information (3i), is stored, and an area 3g is the area in which the number, [num\_words], of character data which can be arranged within the line is stored. In the present embodiment, the offset is always 1 in the case of the first line within the area, and can be obtained by adding [num\_words] to the offset of the line right before the first line in the case of not the first line.

Next, the method of controlling the character arrangement in the present embodiment will hereinbelow be described with reference to a flow chart.

Fig. 4 is a flow chart useful in explaining the line arrangement processing in the area in the present embodiment.

First of all, in Step S401, the work variable n which is used to count the number of lines is initialized to 1. Next, in Step S402, the line information of the n-th line in the area is created. The line information thus created is stored in the area 3c of the line information. The details of the created information is the information stored in the areas 3d to 3g shown in Fig. 3. While the details of the processing of creating the line information which is

executed in Step S402 will be specially described later with reference to a flow chart shown in Fig. 5, when the arrangement of the line can not be carried out in this processing, zero is set to the arrangement

5 judgement variable (ret) of the line (Step S509).

Then, in Step S403, it is judged whether or not the arrangement judgement variable (ret) of the line is zero.

Since if it is judged in Step S403 that  $ret = 0$  is  
10 not established, then this means that the arrangement of the line has been carried out,  $n$  is incremented in Step S404 and then the processing is returned back to Step S402 in which the line information of the next line is created in turn.

15 On the other hand, since if it is judged in Step S403 that  $ret = 0$  is established, no more line can be arranged in the area, in Step S405, in order to store the information relating to up to which line the arrangement has been completed,  $(n - 1)$  is set to the  
20 number, [num\_lines], of lines in the area to complete the processing. The number, [num\_lines], of lines in that area is stored in the area 3a.

The flow chart of Fig. 5 exhibits the processing of creating the line information of the  $n$ -th line in  
25 the present embodiment.

First of all, in Step S501, the line number  $n$  of the line which will be created from now on is set in

the storage area 3d of the line number. This value n is the value which was set in Step S401 or S404. Next, in Step S502, it is judged whether or not  $n = 1$  is established.

5           Since if it is judged in Step S502 that  $n = 1$  is established, then the line information to be created is the line information of the first line within the area, in this case, in Step S505, the setting of the baseline position of the first line is carried out. The  
10          baseline of the first line corresponds to the position which is lower than the upper end of the rectangular area by the character size of the character to be arranged. That is, the following relation is obtained.

$$\text{baseline} = \text{pos\_y} * \text{character size to be arranged} \dots (1)$$

15

In this connection, the character size of the character to be arranged is acquired from the format information which is stored in the area 2h. Then, in Step S506, 1 is set to the work variable (offset) exhibiting the  
20          character position.

On the other hand, since if it is judged in Step S502 that  $n = 1$  is not established, the line information to be created is not the first line within the area, in this case, in Step S503, the baseline of  
25          the line is set on the basis of the following expression:

$$\text{baseline} = \text{baseline} + \text{line pitch} \dots (2)$$

In addition, the work variable offset exhibiting the character position is, from the first offset, [start\_offset], of the line right before the first line and the number, [num\_words], of character data in the line of the line right before the first line, obtained on the basis of the following expression:

$$\text{offset} = \text{start\_offset} + \text{num\_words} \quad \dots (3)$$

Next, in Step S507, it is judged whether or not the line can be arranged in the area. In this connection, that judgement is carried out on the basis of whether or not the baseline which has been calculated in Step S503 or Step S505 is above with respect to the lower end of the area, i.e., the judgement of whether or not the line of interest is contained within the area.

The lower end of the area corresponds to the position which is obtained by adding the height (height) of the rectangular area to the y coordinate value (pos\_y) of the reference point. Therefore, since when the following relation is established;

$$\text{pos\_y} + \text{height} < \text{baseline} \quad \dots (4)$$

it was judged that the line could not go into the area, thereby being determined that the line of interest can not be arranged.

If it is judged in Step S507 that the line of interest can not be arranged, in Step S509, zero is substituted for the arrangement judgement variable,



[ret], of the line to complete the processing.

On the other hand, if it is judged in Step S507 that the line of interest can be arranged, then in Step S508, 1 is substituted for the arrangement judgement variable, [ret], of the line of interest. Thereafter, in Step S510, the numeric value of [offset] is substituted for the first character data offset of the line of interest. Then, the first character data offset of the line of interest is stored in the area 3f.

Next, in Step S511, the work variable [length] exhibiting the length which is occupied by the character line arranged in the line is initialized with zero. Then, in Step S512, it is judged whether or not the width, [width], of the area exceeds the work variable [length].

If it is judged in Step S512 that the width, [width], of the area exceeds [length], then in Step S513, the [offset]-th character is arranged. At this time, the character width of the [offset]-th character data is added to [length]. In Step S514, the value of [offset] is incremented, and then in Step S515, it is judged whether or not there is the next character. If it is judged in Step S515 that there is no next character, then in Step S515, the following expression is judged to be established,

the number of character data < offset ... (5)

and hence in this case, in Step S516, the number of characters in the line is set and the processing completes. In this connection, the number, [num\_words], of characters in the line can be obtained  
5 on the basis of the following expression:

$$\text{num\_words} = \text{offset} - \text{start\_offset} - 1 \quad \dots (6)$$

and is stored in the area 3g.

On the other hand, if it is judged in Step S515 that there is the next character, then the processing  
10 is returned back to the judgement in Step S512 to judge whether or not there is an area in which the character is to be arranged in the line.

In this connection, if it is judged in Step S512 that [length] exceeds the width, [width], of the area,  
15 i.e., if the [offset]-th character is arranged in the line, then the character overflows in the line of interest, then in Step S516, the number of characters in the line is set to complete the processing. At this time, the number of characters in the line can be  
20 obtained on the basis of the above expression (6).

In a manner as described above, the character arrangement in the present embodiment and the setting of the typesetting information resulting therefrom can be carried out.

25 Next, the description will hereinbelow be given with respect to the method of judging the overflow characters in the present embodiment with reference to

a flow chart shown in Fig. 6.

Fig. 6 is a flow chart useful in explaining the processing of judging whether or not there is the overflow characters in the present embodiment.

5 First of all, in Step S601, the line information of the final line (the lowest line) which is arranged in the area of interest is acquired on the basis of the typesetting information. The line information of the final line is stored in the area 3c of the line  
10 information ( $n = \text{num\_lines}$ ) on the basis of the number,  $[\text{num\_lines}]$ , of lines in the area 3a. Next, in Step S602, the final character data of the final line is obtained. The offset of the final character data of the final line can be obtained from the following  
15 expression on the basis of the first character data offset,  $[\text{start\_offset}]$ , of the final line which is stored in the area 3f, and the number,  $[\text{num\_words}]$ , of the characters in the line of the final line which is stored in the area 3g.

20 
$$\text{wCount} = \text{start\_offset} + \text{num\_words} - 1 \quad \dots (7)$$

Next, in Step S603, it is judged whether or not  $[\text{wCount}]$  which has been obtained in Step S602 is equal to the total number,  $[\text{total\_words}]$ , of character data in the area.

25 If it is judged in Step S603 that  $[\text{wCount}]$  which has been obtained in Step S602 is not equal to the total number,  $[\text{total\_words}]$ , of character data in the

area, this means that the character data to be arranged is still present after the final character which is arranged, i.e., there is the overflow characters. In this case, in Step S604, 1 is set to the arrangement judgement variable (ret).

On the other hand, if it is judged in Step S603 that [wCount] which has been obtained in Step S602 is equal to the total number, [total\_words], of character data in the area, this means that up to the final character is arranged, and hence it is judged that there is no overflow character. In this case, in Step S605, zero is set to the variable (ret).

In a manner as described above, it is possible to judge whether or not there is the overflow characters when arranging the characters in the area. This processing is executed after completion of the line arrangement processing in the area in Fig. 4.

Figs. 7A to 7C are respectively diagrams showing picture examples when the area having the character overflow and the area having no character overflow are displayed on the CRT 1 of the apparatus according to the present embodiment.

Fig. 7A shows the displayed picture in the state in which there is no character overflow. In this case, the character line ("ABCDE") is arranged and displayed in the rectangular area.

Fig. 7B shows the displayed picture of the area in

which the overflow characters are present. In this case, while the character line ("ABCDEFGHJKLMNOPQRST") is arranged and displayed in the rectangular area, only up to the character data "ABCDEFGHIJKLMNO" is

5 displayed, and the character data "PQRST" which is to be essentially arranged in this rectangular area is not displayed. In addition, the mark "+" exhibiting that there are the overflow characters is displayed in the bottom right of the rectangular area. Fig. 7C shows  
10 the state in which an operator carries out the edition manipulation of enlarging that area to change the size of that area so that all of the characters including the overflow characters are displayed.

Figs. 8 and 9 are respectively diagrams showing  
15 the picture examples each useful in explaining the manipulation method when moving the character line overflowing from the area.

First of all, in Fig. 8, there is shown the example in which the area (801) and the character line  
20 (802) are both displayed in the state in which there is no character overflow as shown in Fig. 7A. In this case, even when the pointer is moved within the rectangular area containing therein the characters and then the right-hand side button of the mouse is clicked  
25 to display a pop up menu (803) for that area, it is discriminated that no overflow character is present in that area on the basis of the judgement that the

variable (ret) of the area displayed in the cursor position when the mouse is clicked is read out so that zero is set to the variable (ret). Therefore, the sixth item from the top of the menu items, i.e.,

5 "Elimination of Overflow Character Line" is set as the unselectable function and this function is displayed which is different in form from any of other selectable functions as shown in Fig. 8 so as to be able to discriminate that effect.

10 On the other hand, in Fig. 9, there is shown the example in which the area from which the character overflow as shown in Fig. 7B is displayed. In this case, when the pointer is moved within the rectangular area containing therein the characters and then the  
15 right-hand side button of the mouse is clicked to display the pop up menu for that area, on the basis of the judgement that 1 is set to the variable (ret) of that area, it is discriminated that the overflow characters are present in that area, and also the sixth  
20 item from the top of the menu items, i.e., "Elimination of Overflow Character Line" is set as the selectable function. If this item is selected, in actual, the elimination of the overflow character line "PQRST" is executed so that the overflow characters "PQRST" will  
25 be moved to another area. When being intended to move the character line, the character data ranging from the character data next to the final character data of the

final line which was obtained in Step S602 up to the final character data which is stored in the character data information 2i of that area is read out to be moved.

5           Fig. 10 is a diagram showing the change in the data stored in the RAM 8 when moving the character line overflowing from the area in the present embodiment.

By executing the elimination from the information before executing the elimination, the character data  
10       "PQRST" which was not displayed in the area is moved to a new storage area (refer to a part (C) of Fig. 10). The character line "PQRST" thus moved can be inserted into an arbitrary position within the character data which is set in an arbitrary character area.

15       Alternatively, after having enlarged the size of the original area from which the character line has been moved, the character line "PQRST" can also be reinserted into the original positions.

Fig. 11 is a diagram showing an example when the  
20       moved character data is inserted into another character data area in the present embodiment. At the time when the pointer is moved to the area on the CRT 1 in which the character line "12345" is displayed, and then the character cursor is made indicate the position between  
25       "2" and "3" of the character line "12345" to click the right-hand side button of the mouse, the pop up menu is displayed. Then, the fifth item "Paste" of the menu

items is selected, whereby the moved character line  
"PQRST" which has been cut can be inserted into the  
position of the character cursor which has been  
indicated. At this time, as shown in Fig. 12, the  
5 character data within the stored data is changed from  
"12345" to "12PQRST345".

In the case where the range of the character line  
within the character area is specified, the character  
line which has not been inserted, but has been moved  
10 may be replaced with the character line the range of  
which has been specified.

In is to be noted that if the manipulation shown  
in Fig. 11 is not carried out at all, then the  
character data overflowing from the area is left  
15 deleted from the document. Then, if the power source  
is turned OFF, the overflow character data which is  
stored in the RAM 8 until then will be erased. It is  
to be understood that before turning OFF the power  
source, the overflow character may be stored from the  
20 RAM 8 to the HDD 9 or to the FDD 10 to be retained  
therein.

By executing the above-mentioned processings,  
carrying out the judgement and the movement processing  
for the character data overflowing from the area  
25 becomes possible.

As set forth hereinabove, according to the present  
invention, an operator can visually judge whether or



not there is characters which are not arranged in an  
arbitrary character area in the document to overflow  
therefrom, and also can delete the character line of  
interest or can move it to another area by the simple  
5 operation. As a result, there is obtained the effect  
that an operator can edit the character line  
overflowing from the area by the simple operation  
without wasting carelessly the document memory.

While the present invention has been particularly  
10 shown and described with reference to the preferred  
embodiment and the specified modifications thereof, it  
will be understood that the various changes and other  
modifications will occur to those skilled in the art  
without departing from the scope and true spirit of the  
15 invention. The scope of the invention is therefore to  
be determined solely by the appended claims.